

"NOTHOLAENA" IN BRAZIL

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With two plates

MOST AMERICAN species of the complex traditionally referred to *Notholaena* are Cordilleran. Their aggregate range extends, in a relatively narrow belt limited by the extent of the highlands which offer the dry and rocky habitats congenial to these xerophytes, from the southwestern United States to northern Argentina and Chile. One species, *N. dealbata* (Pursh) Kze., occurs in the western half of the Mississippi Basin in the United States; three are endemic in the West Indies; two, *N. obducta* (Mett.) Baker and *N. Hassleri* Weath., extend to low elevations in the basin of the Paraná; and in the highlands of eastern Brazil, mostly in the states of Minas Geraes, Goyaz, and Piauhuy, is found a group of five endemic species (plus a few isolated stations for two varieties of *N. nivea*). Of these outliers, the populations of the Mississippi Basin and of the West Indies are clearly members of otherwise Andean groups. In South America, *N. Hassleri* and *N. obducta* show less close, but still recognizable relationship, the former with *N. sinuata* (Lag.) Kaulf. of wide Andean range, the latter with *N. squamosa* (Gill.) Lowe of Bolivia and northern Argentina. But the five endemics of eastern Brazil are both geographically and morphologically isolated.

Judging from their scanty representation in herbaria, all the east-Brazilian species are rare and local. Although St. Hilaire collected members of the group about 1817, only two species, *N. Pohliana* Kze. (1840) and *N. eriophora* Fée (1850-52), were recognized until 1896, when Taubert added *N. goyazensis*; and nothing resembling a study of the group was made until 1940, when Brade proposed *N. venusta* and gave a key to the whole five.

Brade's knowledge of Brazilian ferns is unsurpassed; that I venture to follow his sketch with discussion of my own is because he goes very little into detail; because I can, I hope, add data inaccessible to him; and because certain points of classification, identity, and nomenclature remain to be considered. They are not all settled here; but it seems worthwhile to set down the information I have, as a step toward better understanding of these still little-known ferns.

Four of the east-Brazilian endemics (*N. venusta*, *N. eriophora*, *N. goyazensis* and *N. geraniifolia*) are closely related and in many ways alike. All have short-repent, often branched rhizomes. The rhizome-scales are narrow, with a weak capillary tip often tortuous in dried material, a more

or less developed castaneous, sclerotic central band, and a narrow, brownish, hyaline margin. The fronds are approximate, forming loose tufts. The blades are more or less strongly pedate; under conditions of drought they curl up into tight little balls with only the lower surface, well protected against excessive transpiration by its tomentum, exposed. Unfortunately for the herbarium-worker, most specimens have been collected in this condition. The indument is lanate and, at least on the lower surface, very dense. In three species it is composed of a close felting of very fine hairs next the leaf-surface, overlaid by longer and coarser hairs, quite like a muskrat's fur. The sori are borne on more or less dilated, clavate or somewhat flabellate vein-ends at or near the margin. The sporangia are of the usual cheilanthoid type — short-stalked, with a narrow ring and a broad stomium of laterally much elongated cells.¹ The spores are also of the type commonest in the Cheilantheae, subglobose and smooth or minutely granular.

The four species have their nearest and their only close relative in *N. inaequalis* Kze. of southern Africa (Cape Colony to Natal, Rhodesia, and Angola), as Kunze himself suggested in describing that species. This is, of course, one more example of a geographic relationship often noted in other groups. In indument and position and structure of sori *N. inaequalis* is quite like its Brazilian brethren, but in it the pedate habit is less developed and the rhizome-scales are larger and of different structure.

In the fifth east-Brazilian species, *N. Pohliana*, rhizome, scales, and sori are similar to those of the other four. But the architecture of the lamina and the indument are quite different, and the pinnules have a very narrow, but definite, hyaline marginal band, expanded into small lobes opposite the soriferous vein-ends — an obvious development in the direction of the false indusia of *Cheilanthes*. Band and lobes are ciliate. Like the others, *N. Pohliana* appears to have no close relatives among Andean species. *N. cinnamomca* Baker of Central America resembles it in habit and indument, but has the leaf-margin quite unmodified and the sori somewhat elongate and borne on scarcely dilated vein-ends a little back from the margin. Christensen (Ind. Fil. 462) has suggested that *N. Pohliana* might be better placed in *Adiantopsis*. Very possibly its affinities do lie with a group of species of Brazil, northern Argentina, and areas between, variously referred to *Adiantopsis* and *Cheilanthes*, such as *A. regularis* (Kze.) Moore and *C. Regnelliana* Mett. These species may eventually be brought together as one of the units in the final arrangement of the Cheilantheae.

The taxonomic treatment which follows is based on material in eleven herbaria, the European visited in 1937 and 1939. They are: Berlin (ab-

¹ They are well figured in Mart. Fl. Bras. 1(2): pl. 66.

breviated as B); British Museum (BM); Field Museum (F)²; Geneva (Gen); Gray Herbarium (G); Kew (K); New York (NY); Paris (P); Philadelphia Academy (Pa); United States National Herbarium (US); Yale University (Y). To the officers of all of them I am greatly indebted for the privilege of examining the specimens under their care — a privilege particularly valuable in a group so inadequately represented in most single herbaria as this.

Characters given in the introduction or in the key are, for the sake of brevity, usually omitted in the descriptions. Many of the place-names, quite unfamiliar to me, were perforce copied, as best I could, from hand-written labels in European herbaria. I have tried to check them with standard atlases (in which they are very often not to be found) and with the recent Millionth Maps of the American Geographical Society (where also I have sometimes failed to find them). If, under these circumstances, I have been guilty of any particularly grotesque mis-spellings or misplacing of localities, I can only beg the indulgence of my South American colleagues.

As in previous papers — *Contrib. Gray Herb.* 127: 3–15 (1939); *Lilloa* 6: 251–275 (1941) — the name *Notholaena* is retained in its traditional broad sense pending a thorough study of all the species concerned.

KEY TO THE BRAZILIAN SPECIES REFERRED TO NOTHOLAENA.

- a.* Indument of hairs. *b.*
b. Lamina deltoid or pentagonal, pinnate-pedate or pedate, usually much shorter than the stipe; lowest pinnae much the largest, usually strongly inequilateral. *c.*
c. Stipe thinly villous with straight, distinctly moniliform, often gland-tipped hairs; lamina with 1–3 wholly free pinnae, the rachis between them not winged; only the basal pinnae deeply divided. 1. *N. venusta.*
c. Stipe lanate with long, tortuous, matted, slender, non-glandular hairs, or glabrous; all segments of the lamina usually connected at least by a narrow wing along the rachis. *d.*
d. Indument of both surfaces of lamina of long, slender, tortuous, obscurely articulate hairs; only the basal segment deeply lobed. 2. *N. eriophora.*
d. Indument of lower surface of lamina of fine, short, densely felted tomentum overlaid by long, straightish, conspicuously articulate hairs, the cross-walls of their cells dark; median segments, as well as the basal, lobed. *e.*
e. Indument of upper surface of lamina of fine, whitish, tortuous, more or less matted hairs; median segments simply pinnatifid, with entire lobes; rhizome-scales bright brown in mass. 3. *N. goyazensis.*
e. Indument of upper surface of lamina of coarse, straightish, golden to whitish, not much matted hairs; median segments sub-bipinnatifid, their lobes more or less cut; rhizome-scales fuscous in mass. 4. *N. geraniiifolia.*
b. Lamina deltoid-lanceolate, bipinnate, equalling or longer than stipe; lowest pinnae not greatly larger than those adjacent, equilateral; indument of lower surface of lamina thin. 5. *N. Pohliana.*
a. Indument ceraceous; lamina at least subtripinnate. *f.*

² Now the Chicago Natural History Museum, but known so long under its old title that it seems more convenient and intelligible to retain the abbreviation "F" for the present.

- f.* Indument white; stipe bright-castaneous; lamina bipinnate above, subtripinnate in lower pinnae.....6a. *N. nivea* var. *oblongata*.
f. Indument yellow; stipe dark-castaneous; well-developed lamina fully tripinnate.
 6b. *N. nivea* var. *flava*.

1. *Notholaena venusta* Brade in Anais Prim. Reun. Sul-Amer. Bot. 2: 7, t. 4, fig. 1, 2 (1940). PLATE I, FIG. 1.

Notholaena capillus St. Hilaire in herb. and ex Christ in Bull. Herb. Boiss. II. 2: 381 (1902), pro syn.

Rhizome about 2 mm. in diameter, its scales about 2 mm. long, sometimes serrulate toward the apex with narrow, ascending teeth; stipe terete, 0.4–0.5 mm. in diameter, 6.5–9 cm. long, castaneous, shining; lamina pentagonal to somewhat elongate-deltoid, 3–4 cm. long, 2–3 cm. wide, commonly fully pinnate to about the third pair of pinnae from base; basal pair of pinnae deeply pinnatifid and more or less inequilateral by the elongation of the basal segment on the lower side, their divisions oblong, obtuse, entire or the developed basal segment shallowly undulate-lobed; median pinnae oblong or linear-oblong, entire or shallowly lobed, rather distant, decreasing rather gradually to a somewhat prolonged, obtuse, narrow, pinnatifid apex; rachis castaneous; tomentum of the upper surface of lamina grayish, of slender, tortuous and matted long hairs, that of the lower surface rufous, of similar hairs underlaid by a dense felt of shorter and finer hairs; veins immersed, ultimate veinlets 1–2-forked, at least the soriferous with rather abruptly dilated, somewhat flabellate ends at or very near the margin; spores about 65 μ in diameter. — Known to me from Minas Geraes and Piahy.

TYPE: Ad rupes, Diamantina, Minas Geraes, June, 1934, *Brade 13494* in herb. Jardim Botânico, Rio de Janeiro; not seen.

Specimens seen. MINAS GERAES: Sub rupibus prope pagum Nossa Senhora da Penha, *St. Hilaire B' 1220* (P)³; Serra de Ibitipoca, June, 1896, *herb. Magalhães Gomes 1099* (P); Serra do Cipó, June, 1901, *Schwacke 14520* (G, P). PIAHY: Without definite locality, 1836, *Gardner 2392* in pt. (P).

Both St. Hilaire, who made the first collection of this "especie graciosa," as Brade appropriately calls it, and Christ gave it herbarium names. Christ suppressed his own, but mentioned St. Hilaire's as a synonym of *N. eriophora*. I used *N. capillus* in labelling sheets at Paris; it must now give way to the properly published *N. venusta*.

Both *N. venusta* and *N. eriophora* have had the misfortune to be described from depauperate specimens, as will appear on comparison of the drawing from an average specimen of St. Hilaire's, reproduced here, with

³ St. Hilaire in his Travels mentions two villages by this name, both in Minas Geraes. One (Voyage dans le District des Diamans, 135) is near what is now Bello Horizonte, about 10 km. north of Caeté and near the Pico da Piedade, of the view of which St. Hilaire writes with appreciation. This village appears on modern maps simply as Penha. The second (Voyages dans les Provinces de Rio de Janeiro et de Minas Geraes 2: 10) is described as near the settlement of Rio Vermelho in the "termo" of Minas Novas. This Nossa Senhora da Penha is not on modern maps; Rio Vermelho appears about 50 km. east of Diamantina. Since St. Hilaire's label reads "in Mina Nova," it is probably the locality from which his no. *B' 1220* came. St. Hilaire says he found no other place in the province with such varied vegetation.

Brade's drawing, and of Fée's original plate of *N. eriophora* with Hooker's later one.

2. *Notholaena eriophora* Fée, Gen. Fil. 159, t. 13, fig. 3 (1850-52) and Crypt. Vasc. Brésil 55 (1869); Baker in Mart. Fl. Bras. 1(2): 541 (1870), excl. t. 66. PLATE I, FIG. 2.

Notholaena palmatifida Kze. Farnkr. 1: 148 (1844), nomen nudum. Based on Gardner 2390.

Polypodium eriophorum (Fée) Hook. Ic. Pl. 10: t. 991 (1854).

Cheilanthes eriophora (Fée) Mett. Cheil. 23 (1859).

Rhizome 2-3 mm. in diameter; stipe terete, 4-11 cm. long, 0.4-0.5 mm. in diameter; lamina pedate-pinnatifid, 2-3.5 cm. long and as broad or somewhat broader, the basal pair of segments usually much produced on the lower side and strongly inequilateral, their basal divisions on the lower side themselves lobed and somewhat inequilateral, all divisions broadly obtuse; upper part of lamina cut to near rachis into 3-4 oblong, obtuse, entire segments, tapering evenly into a broad, short, 3-4-lobed obtuse apex; texture rather thin, the veins, when indument is removed, visible by transmitted light; ultimate veinlets 1-2-forked, their clavate apices a little back from the margin; indument of both surfaces whitish to rufescent; spores about 42 μ in diameter. — Piahy and probably elsewhere.

TYPE: Shady cliffs on the hills near the city of Oeiras, Piahy, March, 1839, Gardner 2390, presumably at Rio de Janeiro; not seen. Isotypes: BM, G, Gen, K, NY, P, US.

Specimens seen. PIAHY: Felsenritzen, Serra Branca, Jan., 1907, Ule 7423 (B); Felsen, Serra do S. Ignacio, Feb., 1907, Ule 46 (B). State uncertain: Rincas das pedras prope Castro, Jan. 8, 1880, Schwacke 2545 (B). Without definite locality: Glaziou 14409 (B, K, P, US); Herb. Kew. 1037 (Y).

The leads for *N. eriophora* in Brade's key read (translated from the Portuguese): "lamina pedate [i. e. without free pinnae] . . . petioles thinly beset with straight hairs perpendicular to it." Exactly the same secondary lead serves for *N. venusta*. He cites, as cotype (I should have supposed it the type) a specimen of Gardner 2390, "ex herb. Fée," sheet no. 30,922 in the herbarium of the Jardim Botânico at Rio de Janeiro, which, of course, he must have seen. Yet his statement is difficult to reconcile with any other evidence.

In the first place, Fée described the stipes in his material as "glaberrimi" — a condition which can readily enough be found in old fronds, the tomentum being deciduous — and they are so figured by him, with the lanate tomentum of the lamina correctly delineated. Hooker figures spreading hairs on the stipes, but his own specimens at Kew, from which his drawing must have been made, show no such thing. Since the tomentum of the lamina is also represented by spreading hairs, one must conclude that Hooker's draughtsman, less accurate and less skilful than Fée's, was merely using a conventional means to indicate any kind of pubescence. All of the nine sheets of Gardner 2390 which I have seen in various herbaria are alike; all show stipes lanate when young, glabrate in age. This does not, of course, preclude the possibility of a mixture

in Gardner's collection. But in all the material I have examined, I have seen stipes with sparse, spreading hairs only in *N. venusta*, which, of course, can be recognized by other characters. It would seem, if Brade's statement is correct for the type of *N. criophora*, that Fée must have had a very depauperate individual of *N. venusta*, not sufficiently developed to show free pinnae, and that he misdescribed the stipe — or that there is a sixth endemic in eastern Brazil unknown to me. In any case, suspecting an error somewhere, I am keeping the name *N. criophora* for the species represented by the nine sheets of *Gardner 2390*.

Phylogenetic conjecture is very likely quite futile in so small and closely knit a group as this; but if it may be permitted, *N. criophora*, as here understood, is to be regarded as the most primitive of the four pedate species. In it, the leaf-margin is, as Mettenius described it, "omnino immutatus"; at least two of the others (I have not found it in *N. venusta*) have definite, if rudimentary, hyaline margins. The indument is simple, of one type of hairs only, as against two or three in the other species. The sori are borne on only moderately dilated vein-ends appreciably back from the margin. If Bower's opinion is correct — and his cautious and carefully reasoned conclusions deserve all respect — the more or less elongate sorus, borne on scarcely modified veins somewhat back from the margin, is primitive in the Cheilantheae. It is to be hoped he is correct, for, on this basis, one can trace an unbroken and very pretty developmental series from the elongate sorus and unmodified vein-ends of *Pellaea* and some species of *Notholaena*, through short sori, clavate, flabellate and transversely dilated vein-ends, approaching nearer and nearer to the margin, in *Notholaena* and *Cheilanthes*, to the marginal coenosorus and transverse vein of *Doryopteris*. In this series *N. criophora* would come somewhat between the pellaeoid and cheilanthoid types, belonging, since the sorus itself is short, to the latter, but preserving something of the former. The other species are purely cheilanthoid. *Notholaena goyazensis* might be considered a derivative of *N. criophora*, and *N. geraniifolia*, with its more complex venation and specialized indument, a still more advanced member of the same line of descent, with *N. venusta* representing a development in a different direction; but there seems little profit in such speculation.

3. *Notholaena goyazensis* Taubert in Bot. Jahrb. 21: 421 (1896). PLATE I, FIG. 3.
Cheilanthes goyazensis (Taubert) Domin in Bibl. Bot. 20: 133 (1915).

Rhizome about 4 mm. in diameter; scales 3–4 mm. long, 0.1–0.2 mm. wide at base, remotely serrulate toward apex, those of the young growth bright brown and concolorous, the older with castaneous, sclerotic central band; stipe 3–10 cm. long, with the tomentum about 1 mm. in diameter, in age glabrate and blackish castaneous; lamina 4.5–6 cm. long, usually about as wide, pinnate-pinnatifid or, in the basal pinnae only, sub-bipinnatifid, these usually connected with those above by a narrow wing along the rachis, inequilaterally elongate-deltoid, the basal segments on the lower side much produced and pinnatifid with oblong, obtuse lobes;

median segments of lamina linear-oblong, equilateral, pinnatifid with oblong, obtuse, entire lobes, the basal lobes adnate to the rachis and forming a broad, basally narrowed wing along it; the 2-4 upper segments rather abruptly contracted into an obtusish, short or sometimes produced, pinnatifid apex; tomentum of upper surface whitish or grayish, that of the lower surface at first whitish, in age dull brown or pale ferruginous; margin of the segments with a very narrow hyaline band, scarcely more than one or two cells wide; ultimate veinlets at an acute angle to the costule, simple or once-forked, the fertile ending at the margin of the leaf-tissue in an abruptly dilated, subflabellate tip; spores about 50μ in diameter. — Minas Geraes and Goyaz.

TYPE: Serra Dourada, Goyaz, Jan., 1893, *Ule* 3222, whereabouts unknown.

SPECIMENS SEEN. MINAS GERAES: São João d'el Rei (Serra de Lenheira), Oct. 13, 1886, *Glaziou* 16643 (B, G, K, P); in locis siccis, Serra do Cipó, April, 1905, *Silveira* (P); on rocks in sandstone area, Serra de Bocaina, Município de Serro, 10 km. north-west of Serro, May 4, 1945, *L. O. Williams* 6871 (G, US). GOYAZ: Entre le village et la Serra dos Crystaes et Caleceira do Rio Samambaia, dans les fissures des roches, Sept. 18, 1895, *Glaziou* 22625 (P); Serra de Caraça, May 28, 1907, *Damazio* 1859 (B, NY, P, US); without definite locality, *Glaziou* 22625 (B, Gen).

As above noted, I failed to find Taubert's type at Berlin. I here use his name in the sense of Christ and Brade, which agrees well enough with the original description. *Ule* 531, from Serra Dourada, Goyaz (P), which I determined in 1937 as *N. criophora*, may belong here. Christ, who seems to have understood this species accurately, so places it (Bull. Herb. Boiss. II. 2: 381). He was, however, thoroughly confused as to *N. criophora*. He cited under it Fée's and Hooker's plates, which are *N. criophora*; plate 66 of the Flora Brasiliensis, which is *N. geraniifolia*; the collections of St. Hilaire, Schwacke, and Magalhães Gomes here referred to *N. venusta*; and no specimens at all of true *N. criophora*, as I understand it.

Taubert's name, as here applied, supersedes an unfortunate manuscript name of mine to be found in several herbaria.

4. *Notholaena geraniifolia* St. Hilaire in herb., sp. nov. PLATE I, FIG. 4; PLATE II. St. Hilarii diagnosis, ipsius manu in schedula scripta, est:

"Stipite gracili, semitereti, subhirsuta: fronde breviuscula profundissime pinnatifida-palmata subtus praecipue hirsutissima: divisionibus angustis pinnatifidis: laciniis breviter linearibus obtusis interdum crenatis — Planta 6-8 pollicaris. Pili paginae inferioris frondis rufi. Stipes atrofuscus."

Quo addendum est sequens. — Rhizoma breviter repens circa 2 mm. diametro, paleis anguste linearibus circa 3-4 mm. longis 0.2 mm. latis medio saturate brunneis subscleroticis, margine angusto hyalino pallido distanter serrulato, apice capillari, dense onustum. Frondes subapproximatae. Stipes quam lamina multo longior (ter vel etiam sexies). Lamina pentagona latitudine longitudinem subaequante; pinnis vel segmentis basalibus inaequaliter deltoideis laciniis basalibus basicopicis valde elongatis profundeque pinnatifidis, laciniis omnibus plus minusve lobatis; segmentis superioribus laminae circa 4-jugis lineari-oblongis obtusis bipinnatifidis laciniis oblongis vel anguste deltoideis adscendentibus, laciniis basalibus

basiscopis in rhachem decurrentibus lobos sicut e rhachi exeuntes patentes formantibus; apice laminae brevi pinnatifido obtuso. Pagina superior laminae subdense hirsutula pilis ex comparatione crassis aureo-brunneis nitidis subrectis vix intricatis; pagina inferior lanata pilis aliis gracillimis brevibus densissime intricatis ferrugineis aliis longis subrectis articulatis. Laciniae margine hyalino angustissimo instructae. Venulae 2-3-furcatis, soros breves ad apicem dilatatum parenchymatis margine extremo gerentes. Sporangia in soro singulo pauca breviter stipitata. Sporae subglobosae circa 45μ diametro laeves vel minute granulatae. — Braziliae in provinciis Minas Geraes et Bahia (?) adhuc lecta.

TYPE: In rupibus prope pagum S. Miguel da Tiquitinhonha, *St. Hilaire B' 1489* in Herb. Paris; seen. Illustration: Mart. Fl. Bras. 1(2): t. 66 (1870), as *N. eriophora*.

Other specimens seen. MINAS GERAES: Serra de Caraça, Nov. 9, 1913, *A. Maublanc 584* (P); Pantano Agosto, *Glaziov 14408* (B, G, Gen, K, P). BAHIA (?): Auf Felsen bei Calderão, 800 m., Oct., 1906, *Ule 7239* (B).

To this species, clearly distinguishable by the architecture of the blade and the character of the indument, Brade applies the name *N. palmatifida* Kze. This I cannot accept. Kunze mentions the name casually in Farnkr. I: 148 as that of a species later to be described, with no word of diagnosis, but with the citation of *Gardner 2390* as its sole basis. This is the type-number of the later *N. eriophora* Fée. Kunze's name had been, until Brade took it up, universally regarded as a direct synonym of *N. eriophora*; this still seems the wisest course.

Kunze in 1845 had been chosen to contribute the treatment of the ferns to the Flora Brasiliensis; he no doubt intended to publish this and some other species, of which he spoke similarly, in that work. At the time of his death in 1851 he had prepared fifteen plates for the Flora which were duly published in 1870 by Baker, who took over the treatment of the ferns. *Plate 66*, which, as Brade points out, represents the present species, is one of the fifteen. Baker remarks (p. 541) that the Kunze specimen figured is more deeply cut than those of Gardner figured by Hooker, but gives no hint as to the name which Kunze had originally attached to his plate and seems by his phrasing to imply that Kunze's specimen was not one of Gardner's. There is no direct evidence that it was. It is possible that there was a mixture in *Gardner 2390*, but, as previously noted, the nine sheets of that number which I have seen are alike, and, though confusion of *N. eriophora* and *N. venusta*, or even *N. goyazensis*, might easily occur, it is much less probable in the case of *N. geraniifolia*.

I have nowhere seen any specimen labelled *N. palmatifida* by Kunze. Until the sheet of *Gardner 2390* which he actually had is discovered, existing evidence should be taken at its face value. It is far better and simpler to suppose that Kunze merely gave a name, which he did not live to publish, to the species later described as *N. eriophora* by Fée, and to take up for the present species the indubitable, though not hitherto published, name of St. Hilaire, than to avoid a new name by applying Kunze's in a sense apparently directly contradicted by his citation of type. This is the easier because *N. palmatifida* was never validly published. It began as a

nomen nudum; had, so far as I know, been cited only in synonymy until Brade accepted it in 1940; and was then not provided with the necessary Latin diagnosis.

5. *Notholaena Pohlana* Kze. Farnkr. 1: 45 (1840); Hook. Sp. Fil. 5: 118, t. 286B (1864); Baker in Mart. Fl. Bras. 1(2): 541, t. 48, fig. 3 (1870).

Cheilanthes Pohlana (Kze.) Mett. Cheil. 23 (1859).

Stipe slender, terete, blackish, dull, glabrous or beset with short, pale, retrorse, sometimes branched trichomes; lamina tapering regularly from base to long-attenuate apex, 8–12 cm. long, 2.5–4 cm. wide, with up to 18 pairs of pinnae; rachis like stipe; lower pinnae with 3–5 pairs of free, oblong or deltoid-ovate, obtuse, entire or sometimes lobed pinnules 6 mm. or less long, and a 3–5-lobed deltoid, obtuse terminal segment; rachilla of pinnae black; texture of blades herbaceous, opaque, the veins immersed, 3–4-forked; both surfaces loosely beset with long, simple, distinctly articulate, pale brownish hairs; spores subglobose, about 50 μ in diameter, tuberculate. — Rio de Janeiro, Minas Geraes, and (?) Goyaz.

TYPE (fide Mettenius): Brazil, Pohl, perhaps at Vienna; not seen. A specimen of Gardner 3554 at Geneva, determined by Kunze, may be taken as authentic.

Specimens seen: "Environs de Rio de Janeiro et d'Ouro Preto," 1883–84, Glaziou 15735 (B, K); Serra da Natividade, Oct., 1839, Gardner 3554 (B, BM, F as 3551, Gen, det. by Kunze, K, P, US).

Kunze put forward *N. Pohlana* somewhat casually, as he did *N. palmatifida*, as a species later to be described. In this instance, however, he stated that the new species resembled *N. tenera* in habit, was hairy on both surfaces of the lamina, and had a creeping rootstock. There is only one Brazilian species referable to *Notholaena* which fulfills these conditions; Kunze's statement may therefore be taken as indicating the identity of his plant well enough to constitute technical publication. Mettenius provided a detailed description under *Cheilanthes* and Hooker added a good plate. These agree and with the specimen at Geneva determined by Kunze fix the identity of the species beyond doubt.

There is some question as to the correct numbering of the Gardner collection cited. Mettenius, Hooker, and Baker all give the number as 3551. Hooker also gives the locality "Serra da Natividade." Yet all the sheets from this locality which I have seen, in seven different herbaria, bear the number 3554, except one at the Chicago Natural History Museum numbered 3551 and one at Kew (where there are two) in which 3551 has been altered to 3554. Since all the specimens appear to be of the same collection, I am taking 3554 as correct.

6a. *Notholaena nivea* (Poir.) Desv. var. *oblongata* Griseb. Symb. Fl. Argent. 342 (1879).

Rhizome short, erect, its scales linear or linear-lanceolate, brown, colorous, with elongate, slender-walled cells; pinnae and pinnules petiolate, the ultimate segments small, oblong and entire or subdeltoid and trilobate, often distant, articulate on their pedicels; sori elongate, occupying at least the outer third of the veins; spores rugose. — Peru, northern Argentina, and Santa Catharina.

TYPE not designated, but said to be from Salta; a specimen at Kew labelled "comm. Grisebach, 1878" is taken as authentic.

Specimens seen: SANTA CATHARINA: San Joaquim, 1000 m., *Spannagel 172* (NY, Pa).

6b. *Notholaena nivea* (Poir.) Desv. var. *flava* Hook. Sp. Fil. 5: 112 (1864).

Notholaena flavens (Sw.) Moore, Ind. Fil. LXX (1857).

Distinguished from the preceding by the characters given in the key.— Colombia along the Andes to northern Argentina; Minas Geraes.

TYPE not designated nor any specimens cited in the original description, but identity clear.

Specimens seen: MINAS GERAES: An Felsen des Campos São Julião, *Schwacke 12764* (P); Miguel Burnier, Preto, *Damazio 1728* (NY, US).

For further discussion and full synonymy of these varieties, see Maxon & Weatherby in *Contrib. Gray Herb.* 127: 10–15 (1939). Christ, quoting Schwacke, states that var. *flava* is very frequent about São Juliao.

It is not clear whether these isolated Brazilian stations are to be interpreted as the result of migration eastward from the Andes or as relics of once wider ranges. In the Andes all varieties of *N. nivea* are plants of rather high altitudes, descending to lower levels only in the more temperate climate of northern Argentina. The nearest known stations are in eastern Bolivia and in the province of Córdoba in Argentina; they are some 800 miles from the Brazilian locality in Santa Catharina and some 1200 from Minas Geraes.⁴ It is possible to postulate a migration-route from eastern Bolivia across the upper Paraná basin, where the gap between the Bolivian and Brazilian highlands narrows to 250 miles, but, pending the discovery of intermediate stations, this must remain pure conjecture.

⁴ The two stations in Minas Geraes are close together, perhaps the same.

EXPLANATION OF PLATES

PLATE I

The drawings are intended to show outline of blade and venation; in all cases, indument and sporangia are removed. Blades are approximately $\times 1$; single pinnae or segments, $\times 3$; fig. 3c, $\times 6$.

FIG. 1. *N. venusta*: a, outline of blade from photograph of *St. Hilaire B' 1220*, type of *N. capillus*; b, median pinna from *Schwacke 14520*. FIG. 2. *N. eriophora*: a, outline of blade, from photograph of a sheet of *Gardner 2390* at Kew; b, median segment from sheet of *Gardner 2390* at Herb. Gray. FIG. 3. *N. goyazensis*: a, outline of blade; b, median segment; c, two lobes of the same; all from *L. O. Williams 6871*. FIG. 4. *N. geraniifolia*: a, outline of blade; b, median segment; both from *Giazou 14408*.

PLATE II

Type of *N. geraniifolia*, *St. Hilaire B' 1489* in Herb. Paris.

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